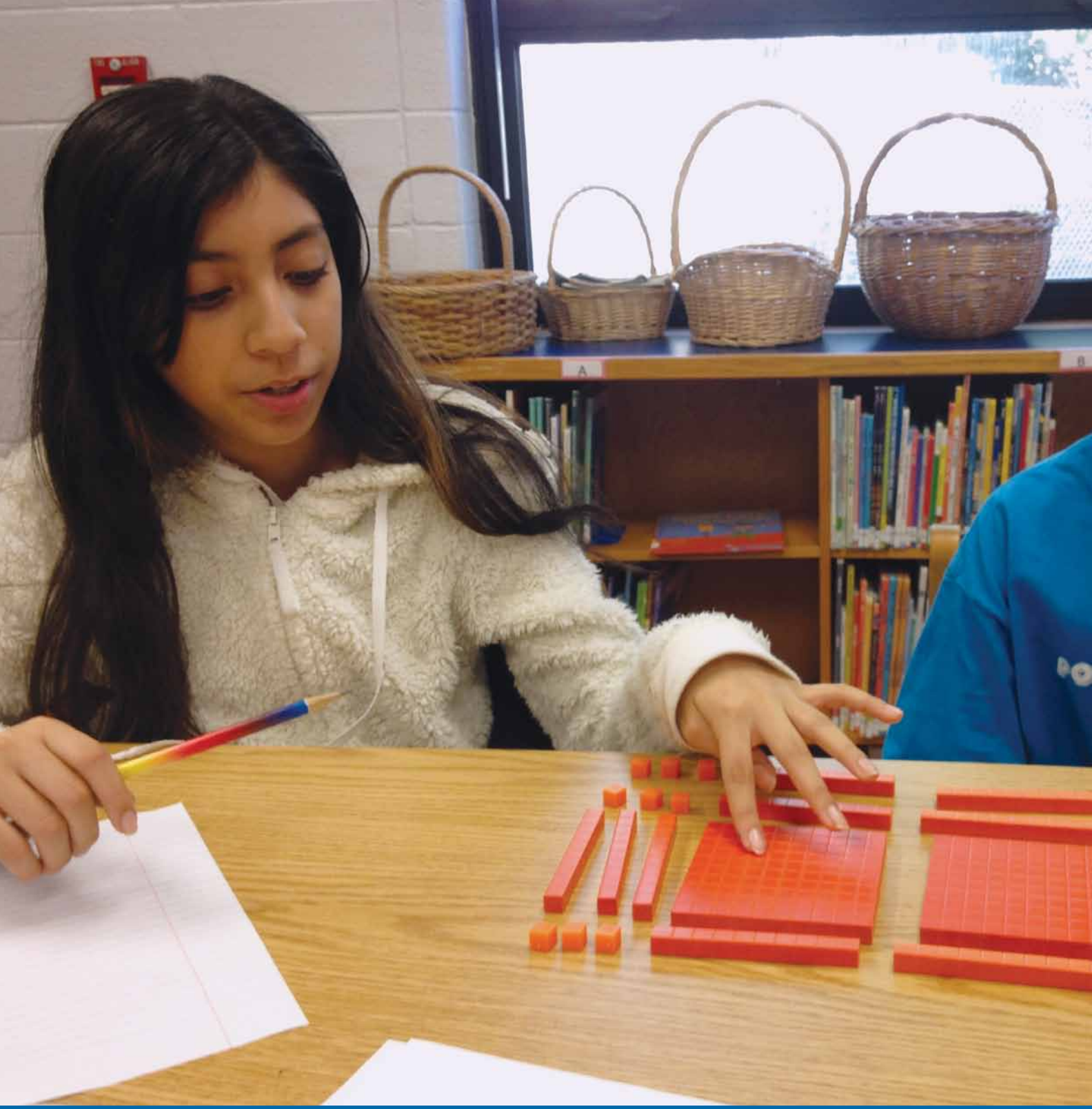

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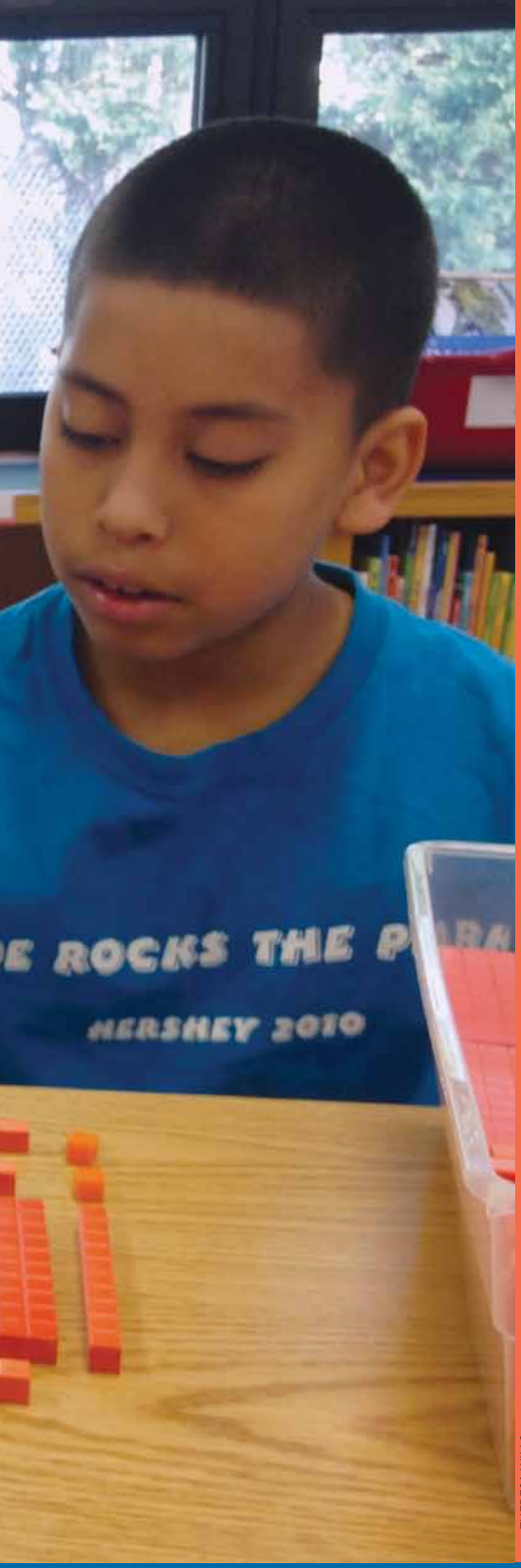

THERESA WILLS

Analyze discourse strategies and dissect simple classroom tools to maximize student engagement and excitement about math.

Molly Rothermel Rawding and Theresa Wills

If you go into Ms. Rotherelli's class, you may notice and hear many things:

- "I know that the perimeter could be 22 inches because I arranged the tiles like this."
- "I found a different perimeter: 50 inches. I knew this 'cause I thought of a really long rectangle. The 24 squares are in a long row."
- "My shape has a perimeter of 50 inches, too, but it's different from what she did. It looks like the letter C."

The task is to identify the dimensions and perimeter of a rectangular yard with an area of 24 in.^{2}, and students are asked to think of ways that they use area and perimeter in their world. Students are talking in small groups about the topic, and the discussions are impressive; conversations are thoughtful, purposeful, and focused on the math. Students refer to a poster on the wall whenever the conversation goes off track or ideas need more clarity. The teacher walks around the room and listens to the discussions.

At one table, students have different perspectives and are able to communicate with one another in a respectful, productive way. The classroom is full of rich discussions that appear effortless. Transitioning from one activity to the next, students are in a routine where math talk is second nature. The teacher is relaxed, and it appears that the students are doing all the work.

A class that has reached this level of discourse takes time, plenty of modeling and practicing, and unrelenting perseverance. Middle school students generally excel at talking—the challenge, however, is focusing the talk around math. The teacher made it look easy, but a skillful observer understands how much time it takes for planning purposeful and meaningful tasks with thought-provoking, rich questions.

SE: Simple Moves That Work

Just as students need plenty of time to practice skills such as solving fraction problems, they also need time to practice the skills of discourse to become better communicators and stronger mathematicians. Embedded within discourse strategies are specific ways to maximize communication. When repeatedly practiced, students learn to listen to one another, give a plethora of answers, and elaborate on ideas. These strategies are a form of scaffolding; the result is effective classroom discourse that provides a foundation for creating authentic classroom discussions.

Students need time to grapple with and make sense of the math in their own way. One way is for students to talk with one another about their thinking. To develop a classroom culture in which all voices are heard, Rotherelli has been most successful when she front loads the rationale about the importance of math talk. As students make sense of the math, they learn that value is placed on their thinking.

Students also learn how to talk as mathematicians by sharing ideas and listening to their peers. These conversations, in turn, influence students to become confident in their communication skills. With teacher support and coaching, students learn to take responsibility for their thinking. Students not only embrace learning while they make meaning of the math but also enjoy the process of learning how to communicate effectively.

BUILDING CLASSROOM COMMUNITY

At the beginning of the year, Rotherelli builds trust and relationships by asking students to interview one another. She models this interview, placing emphasis on learning more about her students' interests and experiences. She uses four categories—achievement, respect, fun, and freedom (ARFF) to guide the interview (McLoughlin 2011):

- *Achievement* focuses on what students believe they do well. Students can be creative and also imagine what they would like to do well. Answers will vary and involve sports and school to babysitting and videogames.
- *Respect* highlights whom the students love and admire and the manner in which they show their love and appreciation.
- *Fun* often incorporates ideas from achievement and also provides insight into personal interests.
- *Freedom* focuses on responsibilities that students carry outside of school and the amount of personal time that they have for themselves.

These interviews, focused on the whole student, build community and trust because they provide an entry point to make connections among students. The interviews are a great opportunity for students to share information about themselves in a positive way. The experience is a version of student discourse and a skillful way to get even the shyest student to open up, thereby building his or her confidence in taking part in classroom discussions.

Pairs of students interview each other, referring to the teacher's earlier model and also asking follow-up questions. These interviews encourage students to learn more about their classmates, discover connections, and build relationships. The class takes off because students experience a sense of community and trust within the classroom.

THE BALANCING ACT OF EQUITABLE TALK TIME

In Rotherelli's classroom, everyone has an opinion, and every opinion matters. This is a result of deliberate modeling and practicing equitable talk time. To achieve such a classroom, she and her coteacher demonstrated a conversation about perimeter in front of the students. Students recorded the amount of time each adult talked, and then the class discussed the importance of equitable talk time.

The next step is for students to practice having short conversations with a peer while monitoring the time each person talks. When beginning these initial discussions, Rotherelli presents engaging questions that connect students' experiences with mathematics, such as, "When were you successful in mathematics?" or "Would you rather go to school from 9:00 a.m. to 2:00 p.m. six days a week or from 10:00 a.m. to 4:00 p.m. five days a week? Why?"

ASKING OPEN-ENDED QUESTIONS

Rotherelli poses open-ended questions such as this:

> The area of this rectangle is 24 in.^{2}. What else could you know?

She knows that by asking questions that are higher on Bloom's taxonomy, she has more options, which will result in a variety of student ideas. Because this was an open-ended question, students responded in many ways:

- "The area could still be 24 in.^{2}, but the perimeter, lots of different numbers."
- "Yeah, the perimeter could be 20 inches. . . ."
- "Or it could be 28 inches because this rectangle has sides that are 12 inches long and 2 inches long."
- "It depends if you want a skinny or squarish rectangle."

Rotherelli knows the challenge of creating thoughtful, provocative questions. She collaborates with other teachers to research other resources

and brainstorm a list of questions, which would both interest the students and foster math discussions. To promote discourse and engagement, she focuses on using a variety of open-ended questions throughout each lesson.

She consistently uses a routine that involves asking questions, looking directly at the student speaker for two seconds, and then scanning the room to monitor the class. The purpose, she shares with the students, is for the speaker to address the entire class. Other students are more likely to respond with either a comment or a question when they are being addressed. West (2011) urges teachers to "get kids to answer a question in a complete sentence—a full thought. That alone will ratchet up your student capacity."

IF YOU ARE WEARING RED, YOU MAY BE CALLED ON SOON

When trying new discourse moves in her classroom, Rotherelli is patient with herself and her students. This may be the first time that students have these opportunities to share their thinking in a focused way. Rotherelli gives students a heads-up before they are asked to answer. Two results of this front-loading strategy are that students are ready to respond to questions and are more confident when doing so. Consider the following discussion:

Teacher: What else do you know about the perimeter of this rectangle? [She allows five to eight seconds of wait time.]

Teacher: Okay. Raymond, what are you thinking? And Jenny, I'm coming to you next to repeat or rephrase some of Raymond's ideas.

Rotherelli's strategy gives Jenny time to focus and listen. "Listening is the bigger part of the discussion," according to West (2011). Because the teacher is deliberately telling Jenny that she will be called on next, she has the flexibility to either repeat or rephrase the mathematics in her own words. As students' confidence and listening skills improve, rephrasing becomes more eloquent. Another time, the teacher might say, "If you are wearing red, you may be called on next."

Just as students need plenty of time to practice skills such as solving fraction problems, they also need time to practice the skills of discourse to become better communicators and stronger mathematicians.

The skill of developing the students' ability to listen and repeat, rather than waiting for the teacher to repeat everything that was said, is practiced often. This strategy also reinforces the idea that students are a source of knowledge, not just the teacher. It also helps develop a classroom climate that promotes respect through listening and acknowledging alternate viewpoints.

HOW DO YOU KNOW?

When Rotherelli poses the question about area and perimeter, students' answers resemble proofs because of the thoroughness of their explanations. The answers, given in complete sentences, also contain a rationale because she practices the skill of asking, "How do you know?" when she receives short answers. This is modeled so often that students hold each other responsible for justifying their reasoning.

Both the teacher and students use mathematical proof language, such as *Is that always the case? Can you think of a nonexample? Can you convince us how that makes sense?* Rotherelli's persistence with asking follow-up questions influences a complete thought and allows students to realize that a fully explained answer is the expectation. Even when students have an incorrect answer, follow-up questions can uncover misconceptions and errors. Classroom talk is effective for revealing students' partial understanding and misconceptions (Chapin, O'Connor, and Anderson 2003).

During a lesson exploring perimeter, she asks a group of students to explain their thinking about a shape with a fixed area of 24 in.^{2}. They share different whole-number answers, representing the following arrays: 24×1, 12×2, 8×3, and 6×4. However, one student is convinced that you could get a perimeter less than 20 inches. To hear how the student is thinking about this problem, Rotherelli asks, "How do you know?" Jasmine replies, "Well, a 6×4 [array] has a perimeter of 20. If you used fractions, you could get a real square, and that would be a smaller perimeter." By asking questions, the teacher uncovers the various layers of students' thinking about mathematics.

MAKING TALKING VISIBLE

The students in this class constantly ask one another follow-up questions to

Table 1. These goals and approaches promote classroom discourse.

I Want More Success in These Areas	Skill to Practice
Students valuing others' opinions	Revisit ARFF interviews, appreciate differences that make students unique
Students having equitable talk time	Practice short, timed dialogue
Students giving a variety of answers	Ask an open-ended question
Students listening to others	Practice repeating and rephrasing
Students elaborating on their answers	Ask, "How do you know?"
More students discussing the topic	Use sentence stems
Facilitating listening when everyone wants to talk	Use "turn and talk" in small groups

gather more information and keep the conversation moving. Students did not walk into her class with this skill; they use the sentence stems that are posted on the board to stimulate discussion. Rotherelli supplies each student with a list of great open-ended questions that can be used in almost any mathematical situation. The list, large enough for students to read, is posted on the wall. The students also have a bookmark in their binders with the same information, and they become accustomed to looking at the question stems whenever the conversation needs more focus or new ideas.

Students also have access to small sheets of scrap paper or sticky notes to jot down their ideas before speaking publicly. This serves two purposes:

1. When students have a great idea, they can remember it without interrupting the person who is talking.
2. When answering a question, students experience the security of being able to refer to or read from the paper.

Students also use sentence stems to add to peers' ideas for even more elaboration. Some examples posted around the room include these:

1. I agree with _____ because. . . .
2. This is what I think. . . .
3. I have a different perspective because. . . .
4. I made a connection with what _____ said. . . .
5. When I thought about the question, I remembered. . . .

Notice that in phrase 3, "I have a different perspective" rather than "I disagree" validates every student's voice. The word *disagree* may insinuate that one person is wrong and another is right, thus ending the conversation. This simple change in wording focuses the outcome on appreciating and considering differing opinions and perspectives.

TURN AND TALK

Although many of Rotherelli's students are ready to talk as soon as she poses her questions, she is never interrupted. This is because she identifies ideal times for students to discuss mathematics in pairs. Her formula is simple:

> Give five seconds of wait time, and see if more than five hands go up. If so, this means that many students are eager to share their ideas.

To engage more students, she initiates "turn and talk" in which students explain their thinking with a partner. Students' oral responses are valued, and Rotherelli knows when enough students have ideas to complete this activity.

She monitors the class during this activity. When she observes students' focus shifting, Rotherelli knows that the class is ready to move to a whole-group discussion. Smith et al. (2009) recommend charting key points in the discussion and orchestrating the order in which to share ideas during this whole-group discussion. When Rotherelli organizes the discussion, it flows gracefully from concrete ideas to abstract counterparts.

NEXT STEPS

To have a class humming with rich conversation about mathematics takes modeling, practice, and perseverance. Day in and day out, the focus must be on having students make sense of the mathematics in a way that incorporates their experiences and current understandings. Building a community of learners through the interviews is the cornerstone to developing a culture in which different opinions and perspectives are appreciated, respected, and celebrated. As a result, students want to share their ideas and communicate respectfully. These strategies have been very important in our classrooms to develop and nurture a community of young mathematicians. "The ultimate goal is to develop student-to-student discourse" that is filled with both excitement and energy (West 2011).

Initiating discourse strategies in the middle of the year is not too late. Teachers can start at any point. For more success with discourse—regardless of what time of the year it is—we recommend focusing on one strategy at a time and explaining the purpose of the exercise to your students. When

you are ready to incorporate a new strategy that influences discourse, identify that strategy, model it, and practice it with your class. Use **table 1** to guide your choice.

With consistent practice and reflection, rich math discussions emerge after several class periods. Students become aware of the discourse moves; they are conscious of equitable talk time as well as appreciating various opinions. It takes time for students to learn how to interact with one another in a way that keeps them focused and engaged in math. "We are growing students as their roots take hold and grow stronger" (McLoughlin 2011). Teachers may start to see "buds" very soon after introducing specific discourse strategies. Some students need additional practice and support to hone their skills of talking with purpose. Over time, teachers will begin to see more and more students blossom and grow as they talk and think like mathematicians and have success communicating their thinking and ideas both in and out of the classroom.

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